STUDENTS' PERCEPTIONS TO USE TECHNOLOGY FOR LEARNING: MEASUREMENT INTEGRITY OF THE MODIFIED FENNEMA-SHERMAN ATTITUDES SCALES

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ABSTRACT
The purpose of this study was in two-fold: (1) to provide the evidence for the reliability of the modified Fennema-Sherman Mathematics Attitude Scales (FSMAS), as translated to Turkish language and transformed to the educational technology context, and (2) to investigate high school students' motivation to use technology for learning by a comparative analysis with respect to varying personal characteristics such as gender, grade level, content area of interest (i.e. science and mathematics, mathematics and social science), and previous experience in using technology for learning. The modified version of FSMAS was administered to 9^{th}-12^{th} grade students at a gifted boarding high school in Istanbul, Turkey. The FSMAS instrument was highly reliable (Cronbach-α, from .942 to .777). The factor analysis showed that there were eight different thematic categories among the items. Overall, findings indicated that students had positive attitudes towards the use of technology for learning, regardless of their various personal characteristics such as gender, age, grade level, previous experience, and content area of interest. In addition, students at lower grades tended to have more satisfaction in using technology compared to the higher graders. Interestingly, more experienced students were less confident in using technology compared to less experienced students. Although female students did not have a negative attitude towards the use computers for learning, they felt less confident in using technology compared to male students. Finally, students good at science and mathematics were more positive about their ability to use technology as compared to their social science counterparts.

1. INTRODUCTION

Motivation plays an important role in learning and therefore its effects are frequently emphasized in various fields of education. Extensive research related to students' motivation for learning, and instructional strategies affecting students' motivation have received continuous attention in educational literature (Angeli, Valanides, & Bonk, 2003; Cronin & Cronin, 1992; Jayaratne, Thomas, & Trautmann, 2003; Keller, 1983; Keller & Kopp, 1987; Ofori & Charlton, 2002; Oliver & Reeves, 1996; Pajares & Graham, 1999; Romano & Brna, 2001; Stevens, Olivarez, Lan, & Tallent-Runnels, 2004; Stoney & Wild, 1998; Wolters & Pintrich, 1998).

However, research on students' perceptions on the use of educational technology for learning seems to be lacking, especially in the Turkish educational context. In response to this need, this study was developed and conducted in two phases: (a) instrument adaptation and integrity analysis and (b) actual data collection and analysis to depict the Turkish students' attitudes on the topic in a large urban setting.

This study focused on the educational technology that may be seen in everyday face-to-face classroom settings or at the distance education systems in the following means: graphics-based calculators, educational software, the Internet, video and other telecommunication devices allowing one to deliver instruction at a distance synchronously or asynchronously. Moreover, according to the relevant literature, the prevalent factors that played role on students' motivation of using technology for learning are gender, previous experience, grade level, and content area of interest. The effects of these factors on students' technology use are discussed in the following sections.

Independent Variables and Relevant Literature

1.1. Gender Difference in Using Technology

Gender comprises a range of differences in characteristics between men and women, which infers not only biological but social. The participants of the current study were opted to reveal their gender as either Male or Female in regards to their participation in this study.

Research on the role of gender differences has contradictory results on students' motivation to use technology. While Comber and Colley (2003; 1997), Kadijevich (2000), and Li and Kirkup (2007) indicated that using computer is a male dominant activity and males have more positive attitudes towards the use of technology as opposed to females, Hurley and Vosburg (1997), Kaino and Salani (2004), and Kay (2006) reported that there is no significant difference between female and male students' attitudes towards the use of technology. In either

case, gender difference becomes an important indicator for attitude-oriented studies and therefore gender became one of the independent variables in this study.

1.2. Previous Experience in Using Technology

Previous experience is another personal characteristic that is related with students' familiarity with the use of technology. Previous experience was determined by the participants' responses to the relevant survey item.

Naturally, experienced students in using technology have more positive attitudes towards the use of technology for learning and they perform better than their counter peers in technology related tasks (Comber & Colley, 1997; Kay, 2006; Mercier, Barron, & O'connor, 2006). Contradictorily, it has also been reported that negative experiences and experiencing problems in the use of technology make students more motivated and skilled in the future tasks (Holt & Crocker, 2000; Russell, Mattson, Devlin, & Atwater, 1990).

1.3. Grade Level Difference in Using Technology

As for the effect of grade level, the studies by Comber and Colley (1997) and Kay (2006) reveal that students in the lower grade levels have more positive attitudes compared to the students in the higher grade levels. Another study conducted by Hurley and Vosburg (1997) indicated no significant difference in the use of technology with respect to grade level differences, in the case of a comparison done between 7^{th} and 8^{th} graders.

1.4. Content Area of Interest in Using Technology

In the literature review, technology usage emerged in different ways in different courses. So, "content area of interest" of students was thought as another critical dimension while investigating students' motivation to use technology for learning. There were two content areas of interest that students had opted for their high school education, which were (a) science and mathematics, and (b) mathematics and social science. With this self-reporting variable, differences between the two groups in their perceptions on the use of technology for learning were investigated.

2. THEORETICAL FRAMEWORK

2.1. ARCS Motivational Categories

Keller (1987) defines motivational categories as *attention, relevance, confidence,* and *satisfaction* (ARCS) (See Table 1). Each of these categories also has subcategories. The first part of Keller's ARCS motivational category is getting and keeping the attention of the learners. According to this model, there are three main ways to gain attention which are *perceptual arouse, inquiry arousal,* and *variability*. Getting attention is important but not enough to motivate the students. Students need to see the relevance of the topic. ARCS model's strategy for relevance includes *goal orientation, motive matching,* and *familiarity*. When the students have a positive expectation for success in learning then they will be more motivated. Confidence category of the model is achieved by three strategies, which are *learning requirements, success opportunities,* and *personal control*. Learners should experience satisfaction or reward from their learning. According to this model the forms of inducing satisfaction in students are *natural consequences, positive consequences,* and *equity*. The ARCS model of motivational categories contributed to the analysis of this research while labeling the factor solutions and discussing the results of the analytic data of the FSMAS.

Table 1 Key concepts in ARCS Motivational Categories

Attention	**Perceptual Arouse:** "Create curiosity, wonderment by using novel approaches, injecting personal and/or emotional material" **Inquiry Arousal:** "Increase curiosity by asking questions, creating paradoxes, generating inquiry, and nurturing thinking challenges" **Variability:** "Sustain interest with variations in presentation style, concrete analogies, human interest examples, and unexpected events"
Relevance	**Goal Orientation:** "Provide statements or examples of the utility of the instruction, and either present goals or have learners define them" **Motive Matching:** "Make instruction responsive to learner motives and values by providing personal achievement opportunities, cooperative activities, leadership responsibilities, and positive role models" **Familiarity:** "Make the materials and concepts familiar by providing concrete examples and analogies related to the learners' work"
Confidence	**Learning Requirements:** "Establish trust and positive expectations by explaining the requirements for success and the evaluative criteria" **Success Opportunities:** "Increase belief in competence by providing many, varied, and

Table 1 Key concepts in ARCS Motivational Categories

	challenging experiences which increase learning success" **Personal Control:** "Use techniques that offer personal control (whenever possible), and provide feedback that attributes success to personal effort"
Satisfaction	**Natural Consequences:** "Provide problems, simulations, or work samples that allow students to see how they can now solve -"real-world problems" **Positive Consequences:** "Use verbal praise, real or symbolic rewards, and incentives, or let students present the results of their efforts ('show and tell') to reward success" **Equity:** "Make performance requirements consistent with stated expectations, and provide consistent measurement standards for all learner's tasks and accomplishments"

2.2. Effects of Technology in Instruction

Research on the use of technology in instruction in various fields of education such as science education, social science education, and mathematics education shows that there is a positive relationship with students' level of learning of the content and with students' motivation to learn the content material.

Ellington (2003, 2006) indicated that while teaching mathematics at K-12, using calculators in testing and instructions resulted in students developing the necessary operational skills in understanding mathematical concepts. In addition, installation of computers into a secondary school showed that there is a relation between use of computers in the classrooms and the students' positive attitudes towards learning (i.e. enjoying the subject, having motivation to learn more) (Wishart & Blease, 1999).

Using videodiscs in classes is another type of educational technology. Bransford, Sherwood, Hasselbring, Kinzer, and Williams (1990) reported that video-based instruction in mathematics courses increased students' memorization and application process in mathematics. Similar to videodisks, in a number of studies it was reported that use of computers provided better learning experiences (Kulik, 1994; Rieber, 1993; Wenglinsky, 1998).

Integrating computers to science curricula is advantageous such as saving time, teaching more effectively, interpreting data, organizing the experimental data in a more meaningful manner, and developing problem-solving skills. Despite these positive effects, it is vital to cautiously integrate technology into instruction. If the learning objectives are unclear and if the technological tool that students use does not require enough guidance to learn; then, there will be confusion and it affects the outcomes (Wenglinsky, 1998). In a course design, where and when to use technology is a crucial decision for the instructor. Consequently, students' motivation to use technology becomes a critical parameter to think of.

Proper use of technology also helps project-based learning in social science courses. In one of the studies that was carried out by Yang (2003), it was reported that having computer assisted projects helped students' deeper understanding of history. Students could achieve complex tasks with the help of technology. During the project work, their motivation was high because technological tools helped them elicit their attentions. After the project, they were motivated to do other projects.

Doppen (2004) investigated student self-efficacy about the use of technology. He reported that a computer-assisted social study instruction helped high school students develop more interactions among themselves and that it grasped students' interest during the course. Similarly, Saye and Brush (2004) noted that technology-assisted learning environments "can support more disciplined inquiry into ill-structured problems" (p. 352), which implies that the use of technology fosters students' interactions among them and with the curriculum material in order to make inquiry happen.

Using computers in instruction fosters students' critical and higher order thinking skills (Lancy, 1990; Ryba & Anderson, 1990). When it comes to motivation Glasser (1986) suggests that students are motivated when the computer-assisted instruction is provided through guided-teaching.

At the university level, in general, faculty members teaching online courses found the experience positive one in spite of its limited amount of interaction with the students compared to the face-to-face instruction, as reported by Fish and Gill (2009). Interaction and interactivity are seen the key component of any instruction. Both terms are used interchangeably for some contexts but there are no settled views of these terms. Please see (Kahveci, 2007a, 2007b, 2009) for extended discussions.

2.3. The Status Quo: Educational Technology in Turkey

In response to the question "Are the companies in Turkey ready for e-learning?", Aydin and Tasci (2005) report their findings of the first 100 companies listed by the 2001 Turkey's Top 500 Major Industrial Enterprises List of the Istanbul Chamber of Industry: *(1) companies in Turkey are overall ready for e-learning although they need a few improvements, (2) there is a lack of human resources in the companies, (3) there are not enough e-learning vendors and/or consultants in Turkey, or companies are not aware of the external resources available to them.* Although, as quoted by Aydin and Tasci, Turkey invests around $1 billion per year on educational technology, it seems there is more research needed on the effects of these investments on students' learning.

Cavas *et. al.* (2009) reported in a study that more than half of the teachers were using technology products in their courses. The study was conducted across Turkey, in seven regions and among varying socio-economic regions. So, again the effects of these efforts as perceived by students need to be investigated.

3. PURPOSE

The expected positive effects of the use of technology in instruction strongly depend on students' self-perceptions about their motivation to use technology. This is a critical issue for the implementation of technology into classes of science and social science disciplines under the assumption that proper technologically oriented materials are developed and teachers are ready to use them in classrooms.

This study was intended to provide research-based evidence on how students perceive their own use of technology for learning. In other words, the purpose of this study was to investigate students' perceptions about their motivation to use technology for learning by a comparative analysis with respect to varying personal characteristics such as gender, grade level, content area of interest, and previous experience in using technologies for learning such as the Internet, educational software, and calculators.

Secondly, a modified version of the Fennema-Sherman Mathematics Attitude Scales (FSMAS) (Fennema & Sherman, 1976) was adapted in this study. The adaptation refers to two modifications, which were (a) the items were translated to Turkish language, and (b) "mathematics" as a subject were reworded by "technology" in the items. In consequence, the integrity of the newly adapted instrument was re-established via elaborate factorial and reliability analyses. Please note that although the instrument was administered in Turkish language, all of the instrument items as given in Table 2 were provided bi-lingual, in English and Turkish languages. Thus, readers have the option for using either version of the instrument in their future work.

4. METHOD

4.1. Sample and Context of Study

This is a survey research (Jaeger, 1988, p.254-77), having the accessible population (Fraenkel & Wallen, 2003, p.97) of 9th through 11th graders in Istanbul, in Turkey; therefore, the sample was constituted of 9th, 10th, and 11th grade students attending to a private boarding high school for gifted pupils. The selection of the school and the sample was random in nature.

As a result, of the total number (N=165) of gifted students registered at the school, 158 students participated to this study, yielding a response rate of 95.8%. Students were almost equal in number with respect to their gender (females, N=68, or 43.0% of the total sample; males, N=90, or 57.0%) but not with respect to grade level (9th grade, N=101, or 66.0% of the total sample; 10th grade, N=27, or 17.6%; 11th grade, N=25, or 16.3%). Students attending this high school were high achievers. In Turkey, to be admitted to some public high schools like Anatolian High School and Science High School, students are selected through a national aptitude test. This private high school requires very high score in the national aptitude test as well as a committee of the school teachers conduct interviews with students before their admissions. The interviewing process aims to determine students' social adaptation ability and intellectual curiosity. In addition, students' middle school GPA scores are considered in the selection. Thus, the school is regarded for gifted students across Turkey. In general, students are diligent, highly motivated, and interested in extracurricular activities. In response to the need of the students, there are activity hours organized by teachers after normal school hours. Students know English in advanced level and the courses are taught in English language. Upon graduation, the adolescents usually go on with their undergraduate education at highly prestigious universities not only in Turkey but also at abroad.

4.2. Measures

Fennama-Sherman's Mathematics Attitude Scale (FSMAS) (Fennema & Sherman, 1976) was re-worded and translated to Turkish language. FSMAS was the only instrument to gather data in this study. By its nature, the instrument consists of positive and negative statements (i.e. items). Items are rated by a conventional Likert-scale, ranging from strongly agree (*scale value* = 1) to strongly disagree (*scale value* = 5). The original FSMAS

(full-version on mathematics attitudes) measures nine dimensions: *(1) Attitude Toward Success in Mathematics Scale, (2) Mathematics as a Male Domain Scale, (3) and (4) Mother/Father Scale, (5) Teacher Scale, (6) Confidence in Learning Mathematics Scale, (7) Mathematics Anxiety Scale, (8) Effectance Motivation Scale in Mathematics,* and *(9) Mathematics Usefulness Scale*. Although a similar pattern was expected, to be certain, a full-factorial analysis was performed on the modified version of the instrument; allowing to label new categories and subsequently carry out the internal consistency analysis.

The development and implementation of the new instrument were completed in four steps:

1. Fennema-Sharman's Mathematics Attitude Scale was translated to Turkish language; five experts and the researchers worked independently at the outset and then a consensus meeting guided the final form of the language translation,
2. The instrument was attained through altering the wording and replacing "mathematics" with "technology."
3. Any item appearing totally irrelevant to technology use for learning was either reworded or removed completely.
4. The instrument was implemented in a pencil and paper format.

5. RESULTS

In the instrument, all of the 57 items, statements that were scaled by the Likert convention, were subject to a factor analysis. As there were modifications on the original instrument, one needs to determine possibly new emerging categories from the data collected. In addition, a new reliability analysis must be undertaken to ensure that the new version of the instrument is internally consistent.

The descriptive statistics along with the corresponding items are given in Table 2. The item numbers correspond to their order in the instrument, and are used in the same fashion in Table 5, reporting factor loadings. Readers are advised to note that the mean values reported in Table 2 were computed over the recoded data. Scorings of the items with negative statements were reversed. This process does not change overall findings; it is preferred to avoid the negative factor loadings of the items in the same category due to their negative meaning.

Table 2. Descriptive statistics. Note that the mean values reported in this table were computed after reversing the scorings of the negative statements.

ITEMS	N	M	s	SK	SESK
Acronyms: **N**=Frequency, **M**=Mean, **s**=Standard Deviation, **SK**=Skewness, **SESK**=Standard Error of Skewness Likert scale: From Strongly Agree=**1** to Strongly Disagree=**5** (Five discreet categories)					
1. Üniversitede teknoloji üzerine bir bölüm seçmeyi planlıyorum. (I plan to major in a technology related department.)	158	2.78	1.303	.145	.193
2. Teknoloji problemleriyle karşılaştığımda kendimi güvende hissediyorum (Generally I have felt secure about attempting technology related problems)	156	2.90	1.076	.036	.194
3. Teknoloji alanında ileri seviyede işler yapabileceğimden eminim (I am sure I can do advanced work in technology)	157	2.78	1.216	.294	.194
4. Teknolojiye hakim olabileceğimden eminim. (I am sure I can use technology.)	158	2.46	1.075	.677	.193
5. Üst seviyedeki teknoloji problemleriyle başa çıkabileceğimi düşünüyorum. (I think I could handle more difficult technology problems)	158	3.02	1.137	.094	.193
6. Teknoloji kullanımı gerektiren derslerde iyi not alabilirim (I can get good grades in the courses related to technology)	158	2.22	.869	.744	.193
7. Teknoloji kullanımı konusunda kendime çok güveniyorum (I have a lot of confidence when it comes to the use of technology)	156	2.77	1.083	.132	.194
8. Teknolojiyi kullanmak konusunda hiç iyi değilim (I am not good at using technology)	158	2.09	1.099	.977	.193

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Acronyms: **N**=Frequency, **M**=Mean, **s**=Standard Deviation, **SK**=Skewness, **SESK**=Standard Error of Skewness Likert scale: From Strongly Agree=**1** to Strongly Disagree=**5** (Five discreet categories)					
9. Teknolojiyi ileri düzeyde kullanabileceğimi sanmıyorum (I don't think I could use advanced technology)	157	2.20	1.065	.823	.194
10. Teknolojiyi iyi kullanabilen birisi değilim (I am not the type to do well in using technology)	158	2.16	1.074	.742	.193
11. Ne kadar uğraşsam da teknolojiyi kullanmak bana zor geliyor (For some reasons even though I work too hard on it, using technology seems unusually hard for me)	158	1.80	.899	1.251	.193
12. Pek çok konuyu halledebiliyorum ama teknolojiyi kullanma konusunda sorun yaşıyorum (Most subjects I can handle okay, but I have a knack for flubbing up the problems about the use of technology)	157	1.96	.953	.976	.194
13. Teknolojiyi kullanmamı gerektiren dersler her zaman en kötü derslerim olmuştur (Technology related courses have been my worst courses)	158	1.75	.975	1.640	.193
14. Teknolojiyi kullanma konusunda mükemmel bir öğrenci olarak bilinmek beni mutlu eder. (It would make me happy to be recognized as an excellent student in the use of technology)	158	2.35	1.173	.564	.193
15. Teknolojiyi kullanma konusunda göze çarpan bir öğrenci olmaktan gurur duyarım (I'd be proud of being the outstanding student in the use of technology)	157	2.36	1.182	.548	.194
16. Teknolojiyi kullandığımız derslerde en yüksek notları almak beni mutlu eder (I'd be happy to get top grades in the courses in which we use technology)	157	2.18	1.131	.840	.194
17. Teknolojiyi kullandığım derslerde ödül almak gerçekten harika olur (It would be really great to win a prize in the courses in which we use technology)	158	2.13	1.133	.893	.193
18. Teknoloji konulu bir yarışmada birinci olmak beni memnun eder (Being first in the competition related with the use of technology would make me pleased)	158	1.97	1.114	1.127	.193
19. Teknolojiyi kullandığımız derslerde zeki olarak sayılmak harika olur. (Being regarded as a smart in the courses in which we use technology would be great thing)	158	2.35	1.205	.784	.193
20. Teknolojiyi kullandığımız derslerde bir ödül kazanmak kendimi bariz bir şekilde mutsuz hissetmeme neden olur. (Winning a prize in technology related courses would make me feel unpleasantly conspicuous)	158	1.87	1.075	1.408	.193
21. Eğer teknolojiyi kullandığımız derslerde en yüksek notları alırsam insanlar benim inek olduğumu düşünür (People would think I was some kind of nerd if I get good grades in technology related courses)	157	2.01	1.106	1.195	.194
22. Teknolojiyi kullandığımız derslerde iyi notlar alırsam bunu saklamaya çalışırım (If I get good grades in technology related course I would try to hide it)	157	1.85	1.043	1.226	.194

Table 2. Descriptive statistics. Note that the mean values reported in this table were computed after reversing the scorings of the negative statements.

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23. Teknolojiyi kullandığımız derslerde en yüksek notu alırsam kimsenin bilmesini istemem. (If I got the highest grades in technology related courses I would prefer no one knew)	157	1.82	.984	1.184	.194
24. Teknolojiyi kullandığımız derslerde gerçekten iyi bir öğrenci olursam bu insanların beni daha az sevmelerine neden olur. (It would make people like me less if I were really good student in the technology related courses)	156	1.59	.915	1.881	.194
25. İnsanların teknolojiyi kullandığımız derslerde zeki olduğumu düşünmelerinden hoşlanmam. (I don't like people to think I am smart in the technology related courses)	157	2.03	1.190	1.094	.194
26. Teknolojiyi kullanmada kızlar da erkekler kadar iyidir. (Females are as good as males in the use of technology)	156	2.38	1.312	.625	.194
27. Teknoloji ile ilgili bir bölüm okumak erkekler için olduğu kadar kızlar için de uygundur. (Studying in a department related to technology is just as appropriate for girls as it is for boys)	156	1.89	.941	.927	.194
28. Teknolojiyi kullanma sırasında çıkan problemleri çözmede bir kıza da erkeğe güvendiğim kadar güvenirim (I would trust a girl as much as I trust a boy to figure out technology related problems)	157	2.32	1.247	.668	.194
29. Kızlar kesinlikle teknolojiyi kullanma konusunda iyi olacak kadar yeterli mantığa sahiptirler. (Women certainly are logical enough to do well in the use of technology)	157	2.10	1.167	.928	.194
30. Bir kızın teknolojinin kullanıldığı derslerde bir dahi olabileceğine inanmak zor. (It is hard to believe that a female could be genius in the courses in which we use technology)	157	2.03	1.163	1.004	.194
31. Teknolojiyi kullanan erkeklerin kızlardan daha fazla olması mantıklı geliyor. (It makes sense that there are more men than women in the use of technology)	158	2.89	1.260	.031	.193
32. Teknolojiyi kullanma konusunda bir problemin çözümünde bir erkeğin yaptığı çözüme bir kızınkinden daha fazla güvenirim. (I would have more faith in the solution of use of technology related problems solved by man than woman)	157	2.55	1.322	.412	.194
33. Teknolojiyi kullanmaktan hoşlanan kızlar biraz tuhaf (Women who like using technology are a bit peculiar)	153	2.08	1.153	.903	.196
35. Teknolojiyi kullanmayı öğrenmeye çalışıyorum çünkü ne kadar yararlı olduğunu biliyorum (I try to use technology since I know how useful it is)	158	1.58	.808	1.639	.193
36. Teknolojiyi etkin bir biçimde kullanabilmek hayatımı kazanmama yardımcı olacak. (Using technology effectively will help me earn a living)	158	1.68	.860	1.270	.193
37. Teknolojiyi kullanmayi öğrenmek zahmete değer ve yararlı bir uğraş. (Learning the use of technology is worthwhile and necessary subjects)	157	1.70	.970	1.699	.194

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38. İlerideki işlerim için teknolojiyi kullanma alanında tam bir usta olmaya ihtiyacım olacak. (I will need a firm mastery using technology in my future work)	157	2.18	1.097	.689	.194
39. Teknolojiyi hayatimın her alanında pek çok şekilde kullanabilirim (I can use technology in every part of my life in different ways)	158	1.65	.814	1.526	.193
40. Teknolojiyi kullanmanın benim hayatımda hiçbir etkisi yok (It does not make any difference whether I use technology)	156	1.43	.746	2.324	.194
41. Teknolojiyi kullanmak benim için ileriki hayatımda önemli olmayacak (The use of technology will not be important in the rest of my life)	157	1.54	.902	2.315	.194
42. Teknolojiyi günlük hayatımda nadiren kullanabileceğim bir alan olarak görüyorum. (I think technology is the area that I use rarely in my life)	158	1.71	1.030	1.673	.193
43. Teknolojiyi kullanmayı gerektiren dersler almak vakit kaybıdır (The courses which reqires the use of technology are the waste of time)	158	1.51	.788	1.896	.193
44. Üniversitede teknoloji kullanmada iyi olmak yetişkin biri olduğumda benim için önemli olmayacak. (In terms of my adult life it is not important to do well in the use of technology in college)	158	1.63	.891	1.778	.193
45. Okuldan mezun olduğumda teknolojiyi çok az kullanacağımı düşünüyorum (I think I will use technology rarely when I graduate)	156	1.72	.989	1.566	.194
46. Teknolojiyi kullanmayı seviyorum (I like using technology)	155	1.77	.972	1.512	.195
48. Teknolojiyle ilgili hemen çözemedigim bir problemle karşılaştığımda çözüm bulana kadar uğraşırım (When I am faced with technology related problem that I cannot solve immediately I stick with it until I solve it)	154	2.42	1.214	2.604	.195
49. Teknoloji gerektiren bir çalışmaya başladığımda bırakmak istemem. (Once I start trying to work on a study related with technology, I find it hard to stop)	155	2.39	1.089	.492	.195
50. Teknolojiyi kullanma konusunda cevaplanmayan bir soru olduğunda sonrasında onunla ilgili düşünmeye devam ederim (When a question left in the use of technology, I will keep on thinking about it)	156	2.37	1.042	.573	.194
51. Hemen anlayamadığım teknolojiyi kullanma konusunda problemler beni üzer. (I am challenged with the problems in the use of technology I cannot understand immediately)	156	2.92	1.145	.152	.194
52. Teknolojiyi kullanırken karşılaştığım problemleri çözmek ilgimi çekmiyor. (Figuring out technology problems does not appeal to me)	155	2.50	1.213	.427	.195
53. Teknolojiyi kullanırken karşılaştığım problemlerin zorluğu ilgimi Çekmiyor (The challenge of technology related problems does not appeal to me)	155	2.40	1.137	.586	.195

Table 2. Descriptive statistics. Note that the mean values reported in this table were computed after reversing the scorings of the negative statements.

ITEMS	N	M	s	SK	SESK
Acronyms: **N**=Frequency, **M**=Mean, **s**=Standard Deviation, **SK**=Skewness, **SESK**=Standard Error of Skewness Likert scale: From Strongly Agree=**1** to Strongly Disagree=**5** (Five discreet categories)					
54. Teknolojiyi kullanmak sıkıcıdır (The use of technology is boring)	156	1.75	1.099	1.752	.194
55. Bazı insanların teknolojiyi kullanmak için bu kadar vakit harcamalarını ve bundan hoşlanıyor gibi görünmelerini anlamıyorum. (I don't understand how some people can spend so much time to use technology and seem to enjoy it)	156	2.05	1.206	1.173	.194
56. Teknolojiyi kullanırken karşılaştığım zor bir problemin çözümünü kendim bulmaktansa başka birinin bana çözümünü söylemesini tercih ederim. (I would rather have someone give me an answer of technology related problems than to solve it by myself)	156	2.41	1.118	.509	.194
57. Teknolojiyi kullanmayı gerektiren derslerde mümkün olduğunca az çalışırım (I do as little work on the courses that requires the use of technology as possible)	156	2.19	1.119	.954	.194

In addition, the frequencies with respect to independent variables are summarized as follows:

- Gender:
    - Female, N=68 (43.0%)
    - Male, N=90 (57.0%)
- Grade Level:
    - 9th Grade: N=101 (66.0%)
    - 10th Grade: N=27 (17.6%)
    - 11th Grade: N=25 (16.3%)
- Previous Experience:
    - More Experienced: N=108 (68.4%)
    - Less Experienced: N=50 (31.6%)
- Area of Interest:
    - Science and Mathematics: N=75 (48.1%)
    - Mathematics and Social Science: N=43 (27.6%)
    - Undecided: N=38 (24.4%)

As listed above, the independent variable, Previous Experience has been reduced to one dichotomy: (a) More Experienced, and (b) Less Experienced. This reduction was done by summing every student's responses for the following three items: Software, the Internet, and Graphing Calculators. The new variable, then, is dichotomized: (a) $7 \leq$ More Experienced ≤ 9, and (b) $3 \leq$ Less Experienced ≤ 6.

Area of Interest refers to two curricular programs offered at the high school. By the end of 9th grade, students choose to continue either Science and Mathematics or Mathematics and Social Science concentrated curricula.

5.1. Factor Analysis

The following conditions were in effect in the factor analysis employed:

1. Items having factor loadings bigger than | 0.40 | (i.e. absolute value of .40) were assigned to a category. Otherwise, they were omitted from the rest of the analysis.
2. A category deriving from factor solutions had to contain at least three items, with eigenvalues bigger than one.

Two tests were run over 57 items: Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity (see Table 3). Kaiser-Meyer-Olkin (.849>.050) suggests that the correlation matrix is not an identity matrix and Bartlett's Test of Sphericity (p=.000<.050) confirms that there is a high correlation among the items. Factor analysis should be run over the data to discern the patterns (Kaiser, 1974).

Table 3. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.849
Bartlett's Test of Sphericity	Approx. Chi-Square	6069.494
	Df	1596
	Sig.	.000

Factor analysis yielded eight factors, (*cut-off*: eigenvalues > 1) and accounted for 65.64 % of the total variance (see Table 4 for the summary of factor analysis and Table 5 for the items' factor loadings). In addition, Table 6 summarizes the factor components with their percent variance explained, the number of the items contributing to the component, and the Cronbach alpha internal consistency values. Overall, the internal consistency analysis indicated that the instrument was highly reliable (.777 ≤ r ≤ .942), and therefore; the data was considered as appropriate for further analyses.

Table 4. Total variance explained. *Extraction Method*: Principal Component Analysis.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	17.273	30.303	30.303	17.273	30.303	30.303	6.995	12.273	12.273
2	6.705	11.764	42.066	6.705	11.764	42.066	6.196	10.870	23.143
3	3.948	6.926	48.993	3.948	6.926	48.993	5.313	9.320	32.463
4	3.156	5.537	54.530	3.156	5.537	54.530	5.080	8.912	41.375
5	2.154	3.778	58.308	2.154	3.778	58.308	4.683	8.217	49.592
6	1.996	3.503	61.811	1.996	3.503	61.811	3.889	6.822	56.414
7	1.576	2.765	64.576	1.576	2.765	64.576	2.645	4.641	61.055
8	1.361	2.388	66.964	1.361	2.388	66.964	2.612	4.583	65.637
9	1.354	2.375	69.339	1.354	2.375	69.339	1.497	2.627	68.264
10	1.175	2.061	71.400	1.175	2.061	71.400	1.481	2.598	70.862
11	1.015	1.780	73.180	1.015	1.780	73.180	1.321	2.317	73.180

Table 5. Rotated component matrix. Rotation converged in 10 iterations. *Extraction Method:* Principal Component Analysis. *Rotation Method:* Varimax with Kaiser Normalization.

Item Number	Components 1	2	3	4	5	6	7	8	9	10	11
1	.077	.206	.684	-.160	-.010	.059	.135	.167	-.036	-.012	-.052
2	.018	.260	.630	-.023	.260	-.140	-.056	.022	.123	.097	-.016
3	.092	.267	.778	-.057	.233	-.012	.114	.213	.043	-.017	-.069
4	.288	.092	.760	-.044	.268	-.026	.076	-.081	-.035	.079	.031
5	.131	.206	.710	-.087	.360	-.161	.024	.020	-.023	-.022	.135
6	.165	.289	.468	-.096	.448	-.064	.200	-.209	.244	.117	.091
7	.130	.202	.610	-.082	.369	-.060	-.036	.091	-.008	.146	-.242
8	.273	.138	.221	.017	.776	.091	-.029	.092	.167	.165	.010
9	.239	.240	.347	.016	.623	.081	.109	.166	-.154	-.017	.213
10	.213	.064	.344	.039	.741	.031	.080	.141	-.086	.166	.022
11	.192	.234	.158	.074	.727	.162	-.058	.216	.042	.020	-.047
12	.134	.150	.235	.090	.785	.066	-.043	.128	.129	-.105	-.102
13	.310	.105	.158	.054	.466	.162	-.012	-.104	.504	-.029	-.017
14	.203	.821	.274	-.001	.099	.060	.082	.075	-.119	.016	.074

Table 5. Rotated component matrix. Rotation converged in 10 iterations. *Extraction Method:* Principal Component Analysis. *Rotation Method:* Varimax with Kaiser Normalization.

Item Number	Components 1	2	3	4	5	6	7	8	9	10	11
15	.190	.859	.210	-.036	.087	.052	-.001	.101	-.017	-.020	.018
16	.169	.820	.272	.041	.119	.074	.094	.066	.023	.078	.006
17	.147	.818	.160	.002	.178	.001	.159	.060	.079	-.033	-.144
18	.173	.756	.187	-.008	.244	.034	.274	.055	.152	-.016	-.047
19	.053	.830	.155	.078	.101	.101	.052	.081	-.048	.009	-.008
20	.275	.258	-.125	.056	.301	.503	.062	.134	.096	.011	-.218
21	.101	-.133	.048	-.118	.100	.490	-.155	.067	.508	-.019	.064
22	.134	.071	-.017	.138	-.045	.798	-.013	.122	.106	-.009	-.041
23	.251	-.019	-.052	.052	-.001	.839	-.033	.065	.126	-.062	.053
24	.334	-.030	-.106	.201	.130	.751	.012	.001	.018	.073	.008
25	.182	.319	-.067	.033	.165	.644	-.001	.059	-.279	.050	.103
26	.028	.087	.034	.837	.025	-.043	.110	.099	.049	.024	-.203
27	.151	.188	-.040	.791	-.023	.105	.097	-.098	.136	-.002	-.098
28	.074	.107	-.158	.839	.034	-.025	.046	-.113	-.061	-.065	-.065
29	.172	.075	-.053	.789	-.005	.145	.172	-.144	-.075	-.008	-.117
30	.026	-.056	-.163	.826	.017	.168	-.074	.167	.023	-.118	.051
31	.045	-.165	.082	.671	.017	.074	-.201	.075	.016	.126	.188
32	.023	-.104	-.020	.819	.043	-.023	-.186	.075	-.084	.024	.193
33	.148	-.261	-.124	.508	.195	.141	.157	-.011	-.060	-.191	.355
34	.329	.191	.210	.140	.255	.206	.298	.026	-.037	-.118	-.489
35	.498	.332	.099	.101	.254	.266	.394	-.041	.008	.084	-.245
36	.604	.267	.260	.098	.183	.234	.346	-.156	-.101	.194	-.117
37	.548	.256	.118	.045	.164	.222	.403	-.135	-.108	-.037	-.080
38	.436	.369	.469	-.066	.017	.117	.334	.036	-.029	-.131	-.095
39	.492	.133	.271	.033	.178	.386	.366	.084	-.010	.101	-.181
40	.797	.120	.040	.181	.207	.290	-.036	.133	-.012	-.037	.022
41	.690	.027	.076	.065	.238	.208	-.056	.111	-.172	.366	.010
42	.805	.103	.218	.045	.161	.107	.041	.173	.046	-.061	.104
43	.796	.219	.133	.143	.131	.139	.021	.160	.104	-.025	.022
44	.747	.149	.096	.162	.134	.151	-.110	.163	.179	-.072	-.062
45	.676	.094	.177	.028	.110	.085	-.108	.281	.161	.218	-.068
46	.354	.459	.311	-.096	.301	.057	.393	-.035	.171	.235	.154
47	.096	.012	.130	-.068	.107	.008	.132	.074	-.013	.904	.009
48	.023	.241	.382	.054	.053	-.007	.592	.071	.186	.005	.142
49	.156	.399	.445	-.051	.072	-.046	.473	.210	.264	.273	-.013
50	.132	.345	.527	.027	.003	.005	.446	.266	.141	.143	-.189
51	-.127	.116	-.014	-.015	-.146	-.154	.666	.114	-.222	.073	-.033
52	.201	.107	.069	-.023	.265	.025	.104	.722	-.040	.045	-.049
53	.258	.146	.184	.015	.149	.155	.073	.793	.049	.018	.022
54	.418	.187	.023	-.011	.341	.188	.092	.405	.381	.012	.210
55	.435	.275	-.015	.206	.225	.100	.076	.345	.302	-.045	.318
56	.433	.114	.249	.069	.037	.319	.012	.583	-.053	.114	.090
57	.493	.188	-.077	.035	.124	.254	.101	.149	.234	.020	.428

Table 6. Summary of factor solutions and their internal consistency analysis.

Components	Labels	Number of Items	Variance Explained	Cronbach Alpha
1	Relevance	15	12.27%	.926
2	Satisfaction	7	10.87%	.942
3	Confidence	10	9.32%	.924
4	Gender Differences	8	8.91%	.902
5	Personal Ability	7	8.22%	.894
6	Social Influence	6	6.82%	.814
7	Perseverance	4	4.64%	.777
8	Interest	4	4.58%	.842

5.2. General Linear Model (GLM) Analysis

General Linear Model (GLM) analyses were carried out by using SPSS 16 (Spss, 2007). GLM lets one compare mean differences of predictors with respect to varying independent variables. This analysis has two advantages over ANOVA: (a) it handles unequal subsample sizes generated by the software for every independent variable categories, and (b) it handles kurtosis values that deviate from normal distribution.

5.2.1. Component 1: Relevance

The GLM analysis over *Relevance* being dependent variable indicated that there was no statistical significant difference among students with varying personal characteristics. The factor loadings for the *Relevance* category show that the item 42 (*factor loading:* .805) best represents this category: “I think technology is the area that I use rarely in my life.” This item is a negative statement; in the analysis the rating of the negative statements was reversed. So, if we rewrite the meaning of item in reversed convention, it reads: “I think the technology is the area that I use often in my life.” The mean value for this item loads very low (M=1.71; SD=1.030), which implies that all of the students regardless of their gender, age, grade level, previous experience, and content area of interest nearly strongly agreed. They use technology in their lives often one way or another and thus, they consider use of technology as being relevant for their lives.

5.2.2. Component 2: Satisfaction

The GLM analysis revealed that *Satisfaction* differs in students’ grade level statistically significantly. The highest loaded item for this category was item 15: “I’d be proud of being the outstanding student in the use of technology,” (M=2.36; SD=1.182). This item is a positive statement; so, its meaning stays as written in the instrument. In general, students tended to have positive attitudes towards the use of technology for their learning. The Likert scale would show between Agree to Somewhat Agree; weighting towards agree level. This finding is also consistent with the previous category, *Relevance*.

The GLM analysis revealed that there was a statistically significant difference among different grade levels, $F(2,158) = 3.311$, p=.040. The mean values with respect to grade level are as follows: 9th grade (M=2.21; SD=1.127), 10th grade (M=2.48; SD=1.341), and 11th grade (M=2.62; SD=1.173). Thus, students at lower grades tended to have more *Satisfaction* in using technology compared to the higher graders.

5.2.3. Component 3: Confidence

Item 3, “I am sure I can do advanced work in technology” (*factor loading:* .778; M=2.78; SD=1.216) loaded highest in this category, the mean value of which implies that students are somewhat *confident* in using technology. This item is a positive statement and its mean value correspond to neutral in the Likert scale used. However, the GLM analysis indicated that there were several statistical significant differences with varying personal characteristics.

Female (M=3.28; SD=1.133) students were less *confident* (please note the Likert scale in Table 2) in using technology compared to male (M=2.46; SD=1.136) students. The effect of *Confidence* was, therefore, highly significant, $F(1,158) = 6.300$, p=.014. On the contrary, more experienced (M=3.18; SD=1.259) students were less confident in using technology compared to less experienced (M=2.49; SD=1.100) students, giving rise to a highly significant effect, $F(1,158) = 6.507$, p=.012. Content area of interest had three categories of effect: mathematics and social science (M=3.18; SD=1.259) showed lowest *Confidence* compared to other groups (science and mathematics (M=2.49; SD=1.100), and undecided (M=3.05; SD=1.229)), giving rise to highly significant effect, $F(2,158) = 8.412$, p=.000. Tenth graders (M=2.59; SD=1.249)) exhibited highest *Confidence* compared to other students (9th graders (M=2.88; SD=1.157) and 11th graders (M=2.83; SD=1.404)). Thus, *Confidence* is highly significant, $F(2,158) = 3.091$, p=.049, with respect to grade level.

5.2.4. Component 4: Gender Differences
Item 28, "Women certainly are logical enough to do well in the use of technology" (*factor loading:* .839; *M*=2.10; *SD*=1.167) loaded highest in *Gender Differences* category. The low mean value implies that students have positive attitudes towards women in using technology. In other words, in general students tend to think that women do have a socially constructed support in their success of using technology. However, the GLM analysis indicated that participants' gender made a statistical significant difference in the responses.

Female (*M*=1.89; *SD*=1.071) students agreed more with women's use of technology compared to male (*M*=2.68; *SD*=1.272) students. The effect of *Gender Differences*, therefore, is highly significant, $F(1,158) = 24.612$, $p=.000$.

5.2.5. Component 5: Perceived Personal Ability
Item 12, "Most subjects I can handle okay, but I have a knack for flubbing up the problems about the use of technology." This statement refers to a negative attitude in the instrument. When it is reverse coded for the analysis; the item reads: "Most subjects I can handle okay, but I do not have a knack for flubbing up the problems about the use of technology," (*factor loading:* .785; *M*=1.96; *SD*=.953) loaded highest in *Perceived Personal Ability* category. Readers are advised to note that the directionally reworded statement is not grammatically quite compelling; however, it is used here to merely warn the reader regarding the meaning of the mean values. In general, all of the students tended to perceive that they were able to use technology for learning tasks. In spite of this general tendency, gender and content area of interest loaded statistically significant difference among their categories.

Male (*M*=1.83; *SD*=.889) students agreed more in terms of their *Perceived Personal Ability* of using technology compared to female (*M*=2.14; *SD*=1.037) students. The effect of *Perceived Personal Ability*, therefore, is statistically significant, $F(1,158) = 4.023$, $p=.047$. As for content area of interest; mathematics and social science (*M*=2.08; *SD*=1.023) demonstrated the lowest *Perceived Personal Ability* compared to other groups (science and mathematics (*M*=1.9; *SD*=1.034), and undecided (*M*=1.86; *SD*=.751)), giving rise to a highly significant effect, $F(2,158) = 5.671$, $p=.005$.

5.2.6. Component 6: Social Influence
Item 23, "If I got the highest grades in technology related courses I would prefer no one knew." This statement refers to a negative attitude in the instrument. When it is reverse coded for the analysis; the item reads: "If I got the highest grades in technology related courses I would prefer everyone knew," (*factor loading:* .839; *M*=1.82; *SD*=.984) loaded highest in *Social Influence* category. All of the students agreed that they would be comfortable in letting others know about their use of technology. Thus, the use of technology for learning was not perceived by the students to be socially discouraging. There are no statistically significant differences in this category with varying personal characteristics.

5.2.7. Component 7: Perseverance
Item 51, "I am challenged with the problems in the use of technology I cannot understand immediately" (*factor loading:* .666; *M*=2.92 *SD*=1.145) loaded highest in *Perseverance* category. The mean value implies that students have neutral attitudes towards *Perseverance* in the use of technology. The GLM analysis indicated that students do not have different positions in the category with respect to their varying personal characteristics.

5.2.8. Component 8: Interest
Item 53, "The challenge of technology related problems does not appeal to me." This statement refers to a negative attitude in the instrument. When it is reverse coded for the analysis; the item reads: "The challenge of technology related problems does appeal to me," (*factor loading:* .793; *M*=2.40; *SD*=1.137) loaded highest in *Interest* category. All of the students agreed that they would be *interested* in problems related to the use of technology. There are no statistically significant differences in this category with varying personal characteristics.

6. DISCUSSION AND CONCLUSION
The findings of the motivation to use technology for learning survey indicated that students perceive the use technology in their lives as a need for learning, regardless of their various personal characteristics such as gender, age, grade level, previous experience, and content area of interest. This conclusion can be evidently

affirmed by looking at the mean values[1] of eight factors: *Relevance* (*M*=1.71; *SD*=1.030), *Satisfaction* (*M*=2.36; *SD*=1.182), *Confidence* (*M*=2.78; *SD*=1.216), *Gender Differences* (*M*=2.10; *SD*=1.167), *Perceived Personal Ability* (*M*=1.96; *SD*=.953), *Social Influence* (*M*=1.82; *SD*=.984), *Perseverance* (*M*=2.92 *SD*=1.145), and *Interest* (*M*=2.40; *SD*=1.137). In addition, one can conclude that students are motivated to use technology for learning and expect that their courses in all areas of education like science, mathematics, and social science include components of technology to enhance their learning.

One important question then arises for educators is: how can we understand what makes a good technological innovation in education? In addressing the roles of pedagogy and people (innovators, educators, and learners) in technology innovations, Ferdig (2005) summarizes the quality criteria of pedagogy: *(1) the innovation must be imbued with authentic, interesting, and challenging academic content, (2) participants must have a sense of ownership, (3) there must be opportunities for active participation, (4) the curriculum and technological tools must provide chances for the creation of artifacts in a variety of ways, (5) publication, reflection, and feedback play a key role throughout the project*; and that of good people: *(1) innovators who recognize the dialogic nature of innovation implementation, (2) innovators who interact with teachers and students in genuine ways, (3) innovators and teachers who understand the flexible nature of both teaching and technology, (4) innovators who provide opportunities for legitimate participation.* Of course, this is one standpoint on the matter, however one should be skeptical about how many technology offers we have at the K-12 level in the various content areas, which are qualified by these pedagogy and good people principles.

The attitudes of Turkish prospective teachers towards the use of computers in education Turkey is very promising, considering the qualities described above. For example, the study by Can and Cagiltay (2006) regarding the use of computer games indicates that:

> The results of the questionnaire show that the participants favored the use of computer games with educational features as a teaching aid in courses (98%) and as a reward (78%) rather than as a main instructional tool (60% disagreed). They responded that games with educational features can be effective for learning when they provide cooperative (85%) learning environments. Similarly, 70% of the participants agreed with the effectiveness of using games when they provide competitive learning environments. (p. 317)

In addition, the motivation to use technology for learning survey revealed that students at lower grades tended to have more satisfaction in using technology compared to the higher graders. Another finding indicated that more experienced students were less confident in using technology compared to less experienced students. When these two findings come together and assuming that higher graders at the same school had been exposed more to technology-oriented curricula, it may be the fact that the higher graders' technology experiences were not completely supportive of a positive attitude.

Although female students did not have a negative attitude towards the use computers for their education, they felt less confident in using technology compared to male students. This finding agrees with numerous research reports (Colley & Comber, 2003; Comber, et al., 1997; Isman & Celikli, 2009; Kadijevich, 2000; Li & Kirkup, 2007) in the sense that male students were more dominant in using technology. However, this inference should be cautiously taken into account as opposing findings such as the ones in the current study emerge. None of the tests conducted in the present study with the data collected via the modified FSMAS provided evidence on female students being less competent than their male counterparts. In fact, the category *Gender Differences* measured that students have positive attitudes in favor of female students in using technology. In addition, as a common sense both male and female students were moderately willing to tackle with problems when they face in using technology for their learning experiences. In a recent study, Dabaj (2009) reports that female students have better perceptions of distance education compared to male students. By its nature, distance education involves technology adaptation to the instruction. Then, although female students may limit themselves in the mechanical use of technology, they still have a good mental adaptation to utilize technology for learning.

Students good at science and mathematics were more positive about their ability to use technology compared to their social science counterparts. This differentiation was not seen in their feeling about *confidence* in using technology. So, perhaps students at social science fields do not get enough practice of technology applications

[1] Please note that all mean values are directionally ensured to be equivalent. i.e. Regardless of positive and negative statements in the original instrument, the Likert scale is valid in all categories as follows: *1-Strongly Agree; 2-Agree; 3-Neutral; 4-Disagree; 5-Strongly Disagree.*

for their learning as much as the other group. Hence, their perceptions about the usefulness of technology for learning may not be as developed as the other group in science and mathematics. There is a need for further research on this issue.

The data shows that the modified FSMAS is reliable and hence, its data is valid for further analysis. The internal consistency analysis reveals that the instrument has the Cronbach alpha values ranging from .942 to .777, referred as highly reliable. The instrument consisted of 57 items in total. The factor analysis showed that there were eight different thematic categories among the items, agreeing with Melancon, Thompson, and Becnel's (1994) on their reliability analysis of FSMAS. The overall meaning deduced to category label was established on the basis of the group of items loaded on a particular category. The category labels turned out to be*: Relevance, Satisfaction, Confidence, Gender Differences, Personal Ability, Social Influence, Perseverance,* and *Interest*. While coding the factor components, the ARCS model of motivational categories guided the analysis of the data. Three factor components were labeled as *Relevance, Satisfaction*, and *Confidence* to make inferences about students' motivation to use technology for learning. These three components inform that students had high motivation to use technology for learning regardless their varying personal characteristics.

In conclusion, this study suggests that students have positive attitudes towards the use of technology for their learning. This finding was derived from student perceptions of varying personal characteristics such as gender, grade level, previous experience, and content area of interest. While designing the new high school curricula in science, mathematics, and social science fields, educators should integrate technological components to foster student learning and motivation to learn.

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